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(54) Title: DENTAL MODEL BASE ASSEMBLY

(57) Abstract: A premanufactured dental model base, and method, for supporting a cast dental model. The dental model base may be selectively connected to an articulator attachment plate which is adaptable for connecting the dental model base to a metal articulator. The same dental model base, at a user's option, may also be connected to a disposable articulator through a groove in the base that engages a disposable articulator tongue or by connecting a disposable articulator ball directly to a socket in the base. Thus, the dental model base may be conveniently used with either a metal articulator or a disposable articulator. In one embodiment, a concave socket at one end of the dental model base may engage an articulator ball or may engage the articulator attachment plate such that the attachment plate is detachably connected to the dental model base.

WO 01/01881 A2

## **DENTAL MODEL BASE ASSEMBLY**

### **Background of the Invention**

This invention relates generally to a dental model base assembly and more particularly to such an assembly in which a premanufactured dental base may, at the option of a technician, be attached either to a disposable dental articulator or to a metal articulator.

Damaged teeth may be repaired or replaced by crowns, bridge inlays or other common dental prosthesis. A successful repair requires accurate alignment and visual uniformity of the repaired tooth with the patient's other teeth. Typically, a model is made of the patient's teeth and the prosthesis is fitted to the model and adjusted to achieve proper alignment and visual uniformity.

The model is typically formed by having a patient bite into a pliant casting material which cures to create a mold cavity having a negative impression of the patient's teeth and gums. The mold can be of all or any portion of the patient's gum line. A castable material is then poured into the negative impression to create a stone replica or dental model of the patient's teeth and gums.

To facilitate prosthesis development, the replica of the damaged tooth or teeth is severed from the remainder of the dental model. In one prior art system, severability is achieved by positioning the knurled end of a tapered dowel pin in the uncured stone material in correspondence with the damaged tooth or teeth. The dowel pin or pins must be carefully aligned and held in position which requires skill and time. Once the casting of the gum and teeth has hardened, the cured dental model is positioned adjacent an uncured dental model base which is held in a dental base mold. The tapered portion of the dowel pins protruding from the dental model are positioned in the uncured dental model base. To prevent bonding of the damaged tooth model with the dental model base, wax may be placed between the base and the dental model and around the tapered portion of the dowel pins associated with the damaged tooth model.

Once the dental model base has cured, a saw cut on each side of the damaged tooth model is made down to the dental model base which allows removal of the damaged tooth model and the attached dowel from the rest of the dental model.

After the damaged tooth model is removed, the prosthesis can be fitted and adjusted without the spacial limitations encountered when the damaged tooth

model is joined to the full dental model. After the prosthesis is made and attached to the dental model segment, the tapered dowel attached to the dental model segment is guided into its respective aperture in the dental model base which guides the dental model segment to its position in the dental model. Alignment and visual conformity are then assessed.

Alignment is ascertained by evaluating the registration of the repaired tooth with the dental model of the patient's opposing teeth. This is achieved by connecting the upper and lower dental model to an articulator. If the prosthesis is out of alignment or does not visually conform to the rest of the patient's teeth, the dental model segment containing the damaged tooth can be removed, adjusted and returned to the dental model base. This process is repeated until proper alignment and visual conformity is achieved. Thus, the model of the damaged tooth may be removed and inserted into the base repeatedly. This repeated removal and reinsertion can damage the fit of the tapered portion of the dowel pin within the cast dental model base which decreases the accuracy of the alignment procedure.

Several plastic dental model bases exist. Examples are described in U.S. Patent No. 5,788,489. These plastic bases facilitate mounting a cast dental model and overcome some of the difficulties inherent in cast dental model bases. However, plastic bases must also be attached to articulators.

The Vertex<sup>®</sup> articulator is one disposable articulator typically used to check the alignment of repaired teeth. The Vertex<sup>®</sup> articulator has a ball and socket joint that permits alignment of the articulator with dental model bases supporting a variety of different dental models. The Vertex<sup>®</sup> articulator socket member is formed with a tongue opposite the socket. The tongue is typically glued to a slot in the rear portion of the cast dental model bases. The Vertex<sup>®</sup> articulator may also be glued to slots formed in plastic dental model bases. An example is depicted in FIG. 9 of U.S. Patent No. 5,788,489.

Other common articulators are metal and the dental model is attached semi-permanently by applying a bonding agent, such as plaster, to the dental model base and the articulator. An example is depicted in FIG. 15 of U.S. Patent No. 5,788,489. While metal articulators may be separated at the hinge, protruding portions of the articulator obstruct access to the dental model from certain directions. A technician may prefer using one type of articulator in certain circumstances and the other when the circumstances are different.

### Summary of the Invention

The present invention is directed to a significant improvement to the invention disclosed in U.S. Patent No. 5,788,489. This invention provides the technician with a unique dental model base assembly that can be used with a variety of articulators types. Thus, increasing the accuracy of the adjustment of the dental model.

In one embodiment of the invention a premanufactured dental model base includes a dental model base body with a dental model support surface. The base body has a wall extending from the dental model support surface. The base body has a first end and a second end, and one of the ends has a socket adapted to engage a ball.

Another embodiment includes a dental model kit that includes, a dental model base that has a socket at a first end and a dental model base coupling at a second end, and an articulator attachment plate. The articulator attachment plate has a ball connected to an attachment plate first end and an attachment plate coupling at an attachment plate second end. The attachment plate coupling is adapted to engage the dental model base coupling. The ball is adapted to slidably engage the socket.

Another embodiment includes a dental model base assembly that includes a dental model base body with a spherical concavity in a first end and a base body connector at a second end and an attachment plate. The attachment plate is disengably connected to the dental model base body connector. The attachment plate has a spherical convex element for engaging the spherical concavity.

Another embodiment includes a method comprising the steps of slidably engaging a ball at a first end of an attachment plate with a socket at a first end of a dental model base. The next step is pivoting the attachment plate relative to the dental model base about the ball and socket. The next step is slidably engaging a connector on the attachment plate with a receiver at the base body second end where the sliding engagement creates a bias between the ball and the connector. The final step is fully engaging the connector with the receiver such that the attachment plate is securely and detachably connected to the dental model base.

Another embodiment includes a premanufactured dental model base that includes dental model base body that has a molar end and an incisor end opposite the molar end. The molar end has a spherical socket sized and positioned

to detachably engage a round portion of an articulator attachment plate or to fixedly connect to a round portion of an articulator.

Another embodiment includes a premanufactured dental model base that includes a dental model support surface and a plurality of tapered pins protruding from the support surface. The pins being of the same material as the base and are formed with the base. A wall adjacent the dental model support surface the wall having a round depression at one end of the dental model base.

Another embodiment includes dental model base that includes a dental model support surface that has a first end and a wall adjacent the dental model support surface first end. The wall has a socket formed adjacent the dental model support surface first end. The socket being engagably at a user's option with either a ball connected to an articulator or with a round portion of an articulator attachment plate

Another embodiment includes an articulator attachment plate that includes an articulator attachment side. The articulator attachment side has plaster retaining protrusions, a dental model side opposite the articulator attachment side, a first and second end, a ball supporting member extending from the dental model side at the first end, a round protrusion extending from the ball supporting member remote from the dental model side, and a hook extending from the dental model attachment side at the second end.

Another embodiment includes a premanufactured dental model base that includes a dental model base body that has a dental model support surface. The base body has a wall extending from the dental model support surface. The base body has a first end and a second end. One of the ends has a ball adapted to engage a socket.

Another embodiment includes a full arch dental model base that includes a dental model support surface. The dental model support surface has an outer perimeter generally following the curvature of a patient's gum, a first end of the support surface corresponding generally to the location of incisors on the gum, and a wall extending from the support surface. The wall being generally perpendicular to the support surface. A connector at the first end of the dental model base. The dental model has a second end remote from the first end. The second end has a first side and a second side. A first concavity at the second end first side and a second concavity at the second end second side. An articulator attachment bar is interposed between the second end first side and the second end second side. The articulator attachment bar has a groove for engaging an articulator tongue.

### **Brief Description of the Drawings**

Figure 1 is a right side, rear and top perspective view of a quadrant dental model base.

Figure 2 is a front elevation view of a quadrant dental model base.

5        Figure 3 is a side elevation view of an attachment plate for a quadrant dental model base.

Figure 4 is a top plan view of an attachment plate for a quadrant dental model base.

10       Figure 5 is a side elevation view of the attachment plate and quadrant dental model base.

Figure 6 is a side elevation view of the attachment plate partially engaged with the quadrant dental model base.

Figure 7 is a side elevation view of the attachment plate fully engaged with the quadrant dental model base.

15       Figure 8 is a right side, rear and top perspective view of a full arch dental model base.

Figure 9 is a top plan view of an attachment plate for a full arch dental model base.

20       Figure 10 is a side elevation view of the attachment plate partially engaged with the full arch dental model base.

Figure 11 is a perspective view of a typical disposable articulator used with the invention.

### **Detailed Description of the Preferred Embodiment**

25       FIG. 1 depicts a quadrant dental model base 20 according to one embodiment of the present invention. In this embodiment, a clear acrylic plastic is preferred, however, many other materials may be used. As shown in FIG. 1, the dental model base 20 has a model support surface 22. The shape of the dental model support surface 22 follows the general contours of half of a normal gum.

30       In this embodiment a plurality of tapered pins 24 are formed with the dental model base 20. The pins 24 are formed of the same material as the base 20 and the base 20 and pins 24 form one integral body. The pins 24 extend from the dental model support surface 22. The pins may releasably engage a cast dental model. Features of the present invention may be adapted to other premanufactured base designs such as those described in U.S. Patent Nos. 5,788,489.

A wall 26 extends from the dental model support surface 22 opposite the pins 24. The wall 26 generally follows the periphery of the dental model support surface 22.

5 The front 28 of the dental model base 20 is configured to support the front of a dental model. In other words, the pins 24 at the front 28 of the base 20 should align generally with the casting of a patient's incisors.

The rear 30 of the base 20 is configured to support the rear of a dental model. In other words, the pins 24 at the rear 30 of the base 20 should align generally with the casting of the patient's molars.

10 The rear 30 of the base 20 has an articulator attachment groove 32 formed across a socket 34. The socket 34 defines a hemispheric void.

As shown in FIG. 2, the front 28 of the base 20 has a recess 36 forming a notch 38.

15 FIGS. 3 and 4 show an attachment plate 40. The attachment plate 40 has an articulator attachment side 42 and a base engagement side 44. A hook 46 is at one end of the attachment plate 40. A hemisphere or ball 48 is connected to the opposite end of the attachment plate 40 by a hemisphere connecting member 50.

20 The attachment plate 40 has two posts 52 positioned in a void on the articulator attachment side 42 of the attachment plate 40. The posts are tapered slightly such that the base of each post 54 has a smaller diameter than the head of the post 56. Also, the walls 58 defining the void on the articulator attachment side 42 of the attachment plate 40 are tapered such that the walls 58 are thicker at the articulator attachment side surface 42 than at the base of the void. The tapered posts 52 and walls 58 aid in securing the attachment plate 40 to a typical metal articulator.

25 The attachment plate 40 is connected to the base 20 by placing the hemisphere or ball 48 in the socket 34 formed in the rear 30 of the base 20, as shown in FIG. 5. The attachment plate 40 is then rotated about the ball 48 and socket 34 relative to the base 20.

30 As shown in FIG. 6, the hook 46 slidably engages the recess 36 in the base 20. As pressure is applied to join the base 20 and attachment plate 40, the hook 46 slides along the inclined plane 60 of the recess 36. When the attachment plate 40 is properly engaged with the base 20, as shown in FIG. 7, the hook 46 engages the recess notch 38 and secures the attachment plate 40 to the base 20.

35 Figure 8 depicts a base 20a configured to support a full arch dental model. As shown, the full arch base 20a has two sockets 34a at the rear 30a of the

base 20a. Figure 9 depicts an articulator attachment plate 40a for a full arch dental model base. The attachment plate 40a has tapered posts 52a and tapered walls 58a for securing the plate to a metal articulator. Two hemisphere connecting members 50a connect a pair of hemispheres or balls 48a to the rear of plate 40a. A hook 46a  
5 extends from the front of the plate. Two vertical slots 61 are located near the rear of the full arch base 20a.

As depicted in FIG. 10, the full arch base 20a has a recess 36a and notch 38a. A full arch attachment plate 40a is connected to a full arch base 20a by inserting two full arch attachment plate balls 48a into the two full arch base sockets  
10 24a and thereafter proceeding as described above.

The full arch base 20a may be connected to a disposable articulator 62 by sliding an articulator attachment bar 64 into the vertical slots 61. As shown in FIG. 11, the attachment bar has two flanges 66 that slidably engage the vertical slots 61. The articulator 62 is defined by a flexible hinge and a pair of ball and socket  
15 joints 70. The articulator ball 72 engages an articulator socket 74 which may be attached to a base by inserting an articulator tongue 76 into a groove 78 in an articulator attachment bar 64. It was also known to insert the tongue 76 into a groove in a cast base.

If a technician chooses to use a metal articulator, he or she may  
20 connect an articulator attachment plate to a dental model base as described above. Plaster may then be used to secure the plate to the metal articulator.

If the technician chooses to use a disposable articulator, the technician may simply insert the articulator tongue 76 into the groove 32 at the rear of the quadrant base 20. If a full arch base is used, the tongue 76 can be inserted into  
25 the articulator attachment bar groove 78 after the attachment bar 64 is fixed to the full arch base 20a.

Alternatively, the technician may remove the disposable articulator socket 74 and place the articulator ball 72 directly in the socket 34 at the rear of the base 20.

30 The foregoing describes various embodiments of the claimed invention. The claimed inventions are not limited to the embodiments described above. For example, it is contemplated that the principles of the invention described above can be applied to numerous different dental model base designs. It is also contemplated that a socket could be formed in a disposable articulator that would



engage a ball formed at the rear of the dental model base. Numerous other alternative constructions exist that fall within the scope of the claimed invention.

**I CLAIM:**

1. A premanufactured dental model base comprising:  
a dental model base body, said dental model base body having a dental model  
5 support surface;  
said base body having a wall extending from said dental model support  
surface;  
said base body having a first end and a second end, and one of said ends  
having a socket adapted to engage a ball.  
10
2. The dental model base of claim 1 wherein:  
said dental model base body has a slot at one of said ends adapted to engage  
a disposable articulator.
- 15 3. The dental model base of claim 1 wherein:  
said socket is adapted to engage a ball connected to a disposable articulator.
4. The dental model base of claim 1 wherein:  
said socket is adapted to engage an articulator attachment plate.  
20
5. The dental model base of claim 1 wherein:  
said socket is a first socket;  
said dental model support surface is adapted to support a full arch dental  
model;  
25 said first end of said dental model base body corresponds to the molar  
portion of said full arch dental model;  
said first end having a first side corresponding to the left molars on the dental  
model and a second side corresponding to the right molars on the dental model; and  
said dental model base body having said first socket on said first side of said  
30 first end and a second socket on said second side of said first end.
6. The dental model base of claim 5 further comprising:  
an articulator attachment bar;

said articulator attached bar interposed between said dental model base body first end first side and said dental model base body first end second side.

5 7. The dental model base of claim 6 wherein:  
said attachment bar is slidably engageable with said dental model base body.

8. The dental model base of claim 1 wherein:  
said dental model base has a plurality of integral pins protruding from said  
10 dental model support surface; and  
said pins adapted to slidably engage a cast dental model.

9. The dental model base of claim 1 wherein:  
a plurality of apertures pass through said dental model support surface and  
15 said dental model base.

10. The dental model base of claim 9 wherein:  
said apertures are adapted to engage pins connected to a dental model.

20 11. The dental model base of claim 9 wherein;  
said apertures are adapted to form stone dowels; and  
said stone dowels formed with said dental model.

12. A dental model kit comprising:  
25 a dental model base;  
said dental model base having a socket at a first end and a dental  
model base coupling at a second end; and  
an articulator attachment plate;

30 said articulator attachment plate having a ball connected to an  
attachment plate first end and an attachment plate coupling at an attachment  
plate second end wherein said attachment plate coupling is adapted to engage  
said dental model base coupling and said ball is adapted to slidably engage  
said socket.

13. The dental model kit of claim 12 further comprising:  
an articulator attachment bar.
14. The dental model kit of claim 12 further comprising a disposable articulator.
- 5 15. A dental model base assembly comprising:  
a dental model base body, said dental model base body having spherical  
concavity in a first end and a base body connector at a second end; and  
an attachment plate;  
10 said attachment plate disengably connected to said dental model base  
body connector;  
said attachment plate having a spherical convex element engaging  
said spherical concavity.
- 15 16. The dental model assembly of claim 15 wherein:  
said spherical convex element is biased to secure said attachment plate to  
said dental model base body.
17. A method comprising the steps of:  
20 slidingly engaging a ball at a first end of an attachment plate with a socket at  
a first end of a dental model base;  
pivoting said attachment plate relative to said dental model base about said  
ball and socket;  
slidingly engaging a connector on said attachment plate with a receiver at  
25 said base body second end wherein said sliding engagement creates a bias between  
said ball and said connector; and  
fully engaging said connector with said receiver such that said attachment  
plate is securely and detachably connected to said dental model base.
- 30 18. The method of claim 17 wherein:  
said full engagement of said connector with said receiver releases a portion  
of said bias.
19. The method of claim 17 wherein:

said engagement releases substantially all of said bias.

20. The method of claim 17 additionally comprises the step of connecting said articulator attachment plate to an articulator.

5

21. A premanufactured dental model base comprising:  
a dental model base body;  
said dental model base body having a molar end and an incisor end opposite said molar end;

10 said molar end having a spherical socket sized and positioned to detachably engage a round portion of an articulator attachment plate or to fixedly connect to a round portion of an articulator.

22. The premanufactured dental model base of claim 21 wherein:  
15 said base has a slot at said molar end;  
said slot sized and positioned to receive a tongue connected to an articulator.

23. A premanufactured dental model base comprising:  
a dental model support surface;  
20 a plurality of tapered pins protruding from said support surface;  
said pins being of the same material as said base, said pins formed with said base; and  
a wall adjacent said dental model support surface said wall having a round depression at one end of said dental model base.

25

24. The premanufactured dental model base of claim 23 wherein:  
said round depression is a socket;  
said dental model base has a second end remote from said first end; and  
said dental model base has a receiver at said second end.

30

25. A dental model base comprising:  
a dental model support surface;  
said dental model support surface having a first end;  
a wall adjacent said dental model support surface, said wall having a socket  
35 formed adjacent said dental model support surface first end said socket being

engagably at a user's option with either a ball connected to an articulator or with a round portion of an articulator attachment plate.

26. An articulator attachment plate comprising:  
5 an articulator attachment side, said articulator attachment side having plaster retaining protrusions;  
a dental model side opposite said articulator attachment side;  
a first and second end;  
a ball supporting member extending from said dental model side at said first  
10 end;  
a round protrusion extending from said ball supporting member remote from said dental model side; and  
a hook extending from said dental model attachment side at said second end.
27. A premanufactured dental model base comprising:  
15 a dental model base body, said dental model base body having a dental model support surface;  
said base body having a wall extending from said dental model support surface;  
20 said base body having a first end and a second end, one of said ends having a ball adapted to engage a socket.
28. A full arch dental model base comprising:  
25 a dental model support surface;  
said dental model support surface having an outer perimeter generally following the curvature of a patient's gum;  
a first end of said support surface corresponding generally to the location of incisors on said gum;  
30 a wall extending from said support surface, said wall being generally perpendicular to said support surface;  
a connector at said first end of said dental model base;  
said dental model having a second end remote from said first end, said second end having a first side and a second side;

a first concavity at said second end first side and a second concavity at said second end second side;

- an articulator attachment bar interposed between said second end first side and said second end second side said articulator attachment bar having a groove for engaging an articulator tongue.
- 5

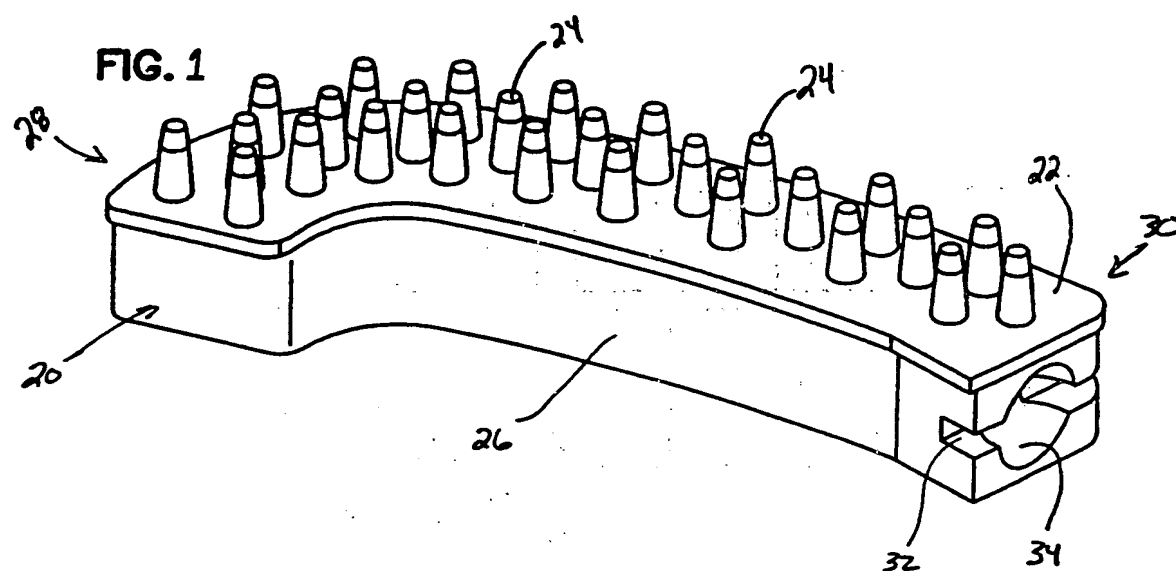
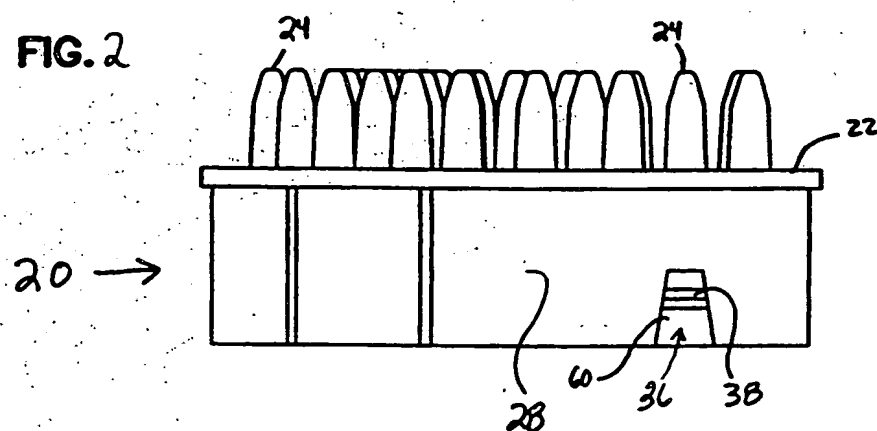




FIG. 2



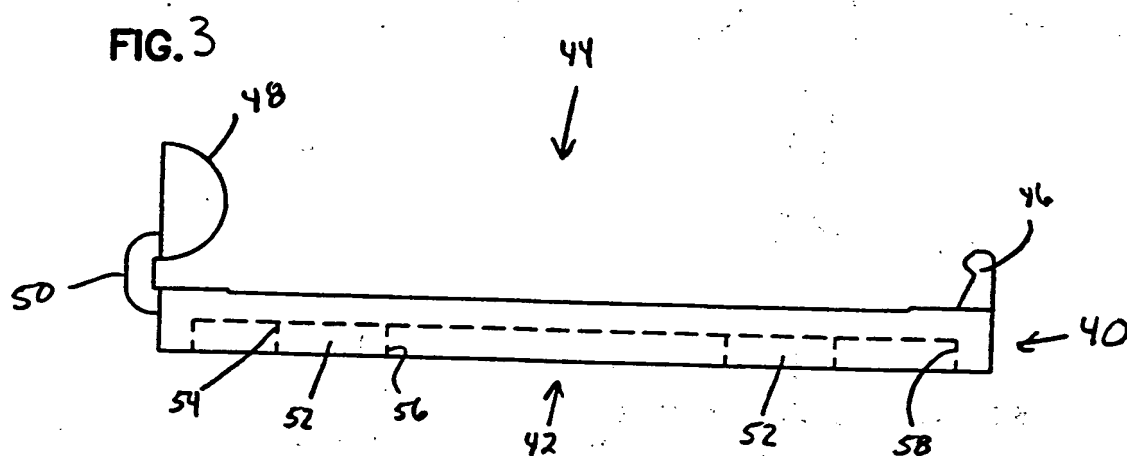
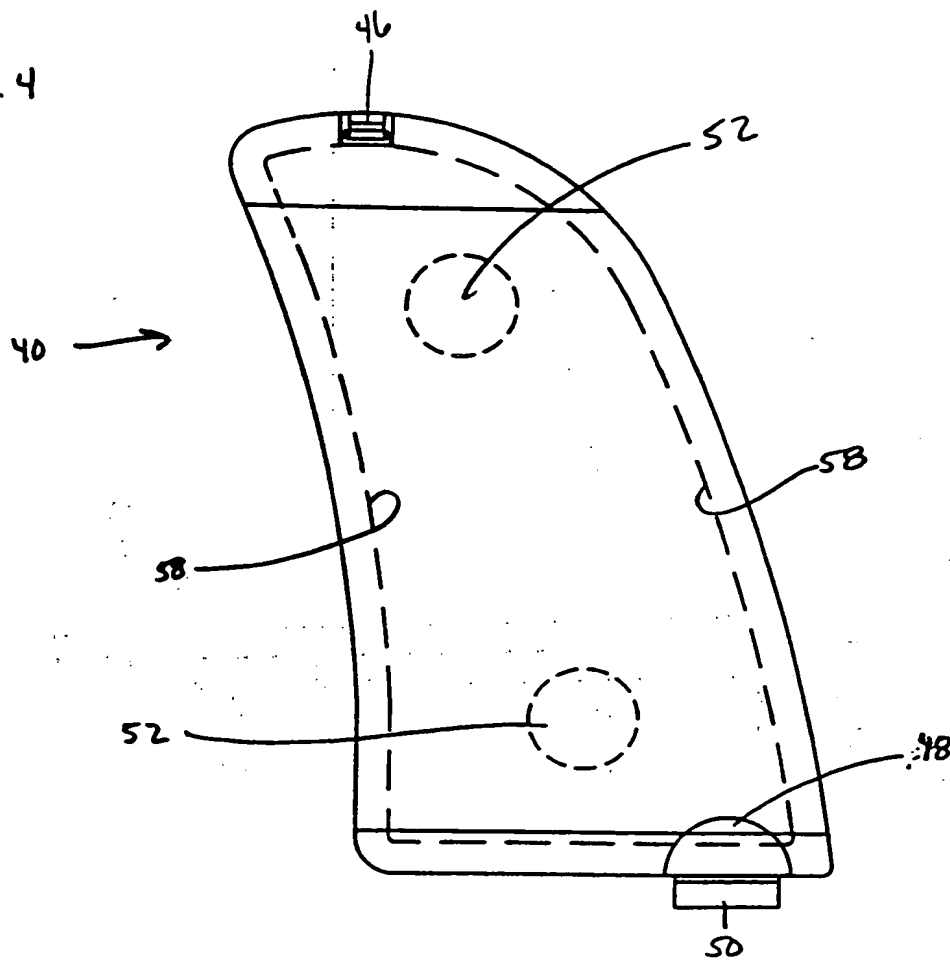
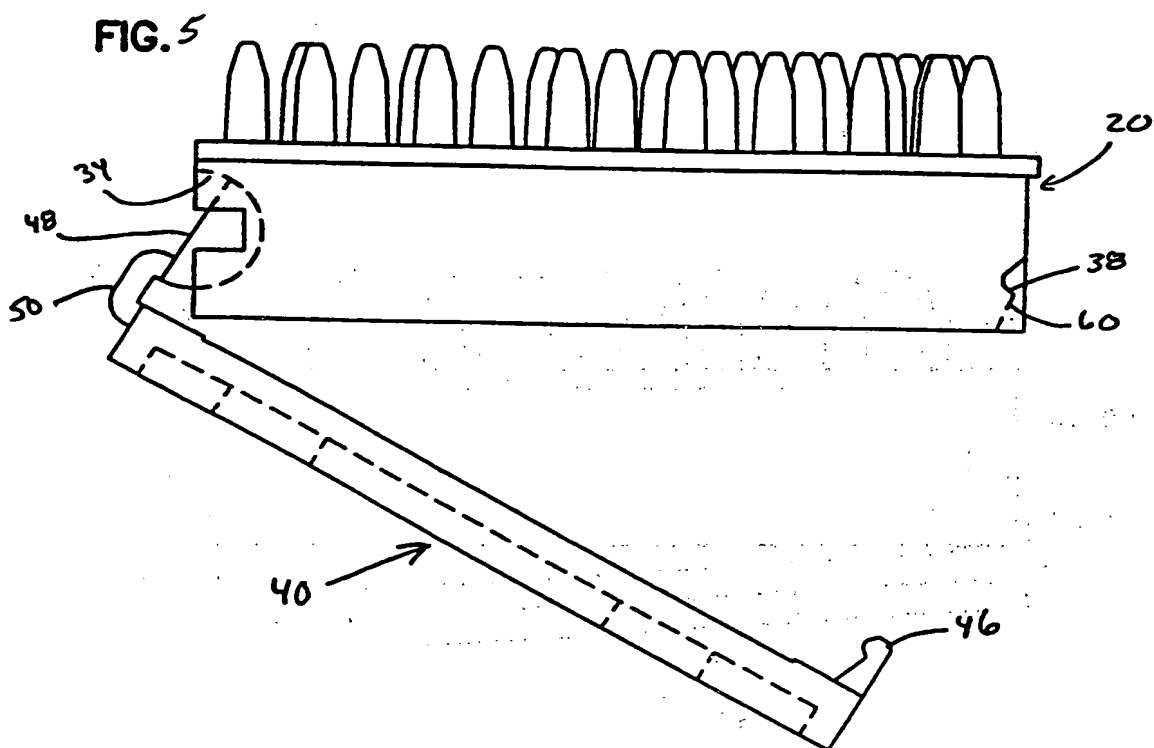


Fig. 4





6/11

FIG. 6

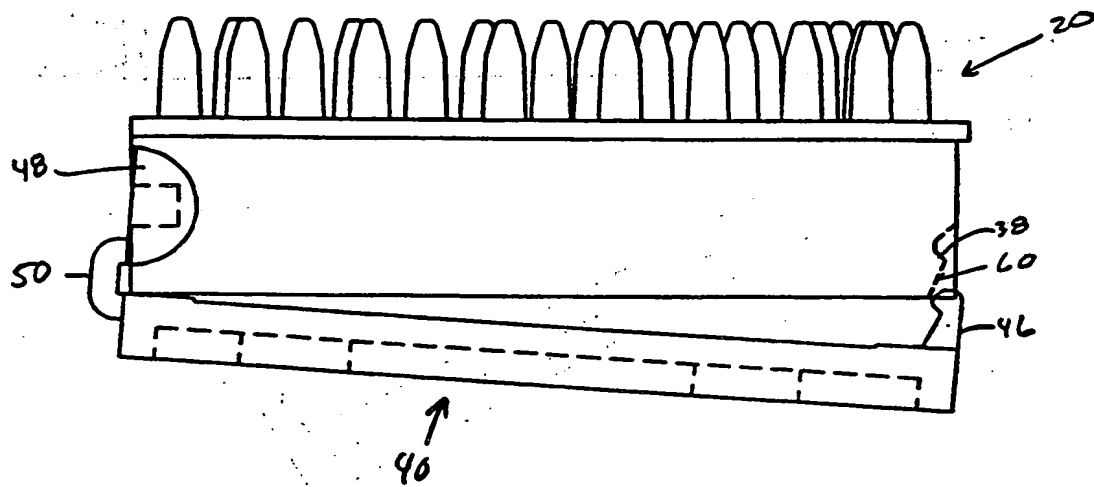
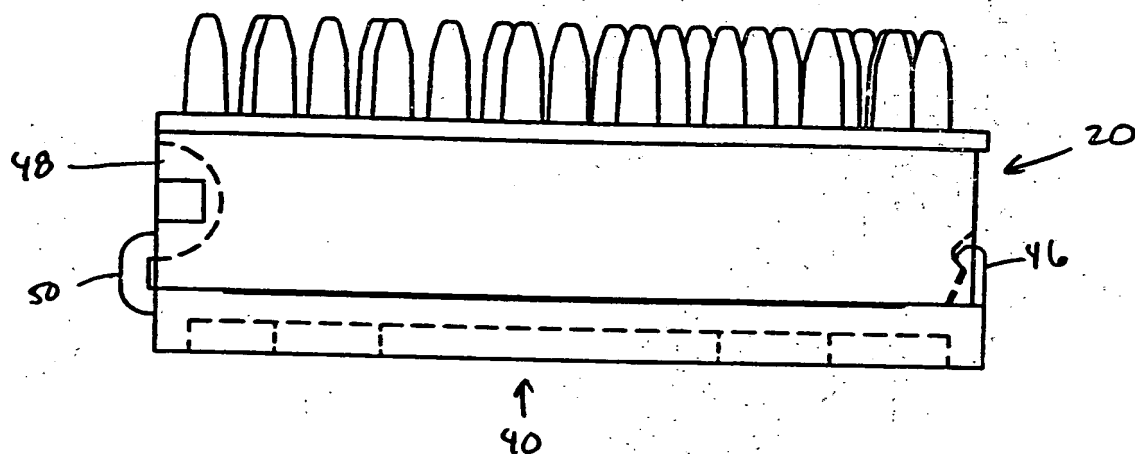
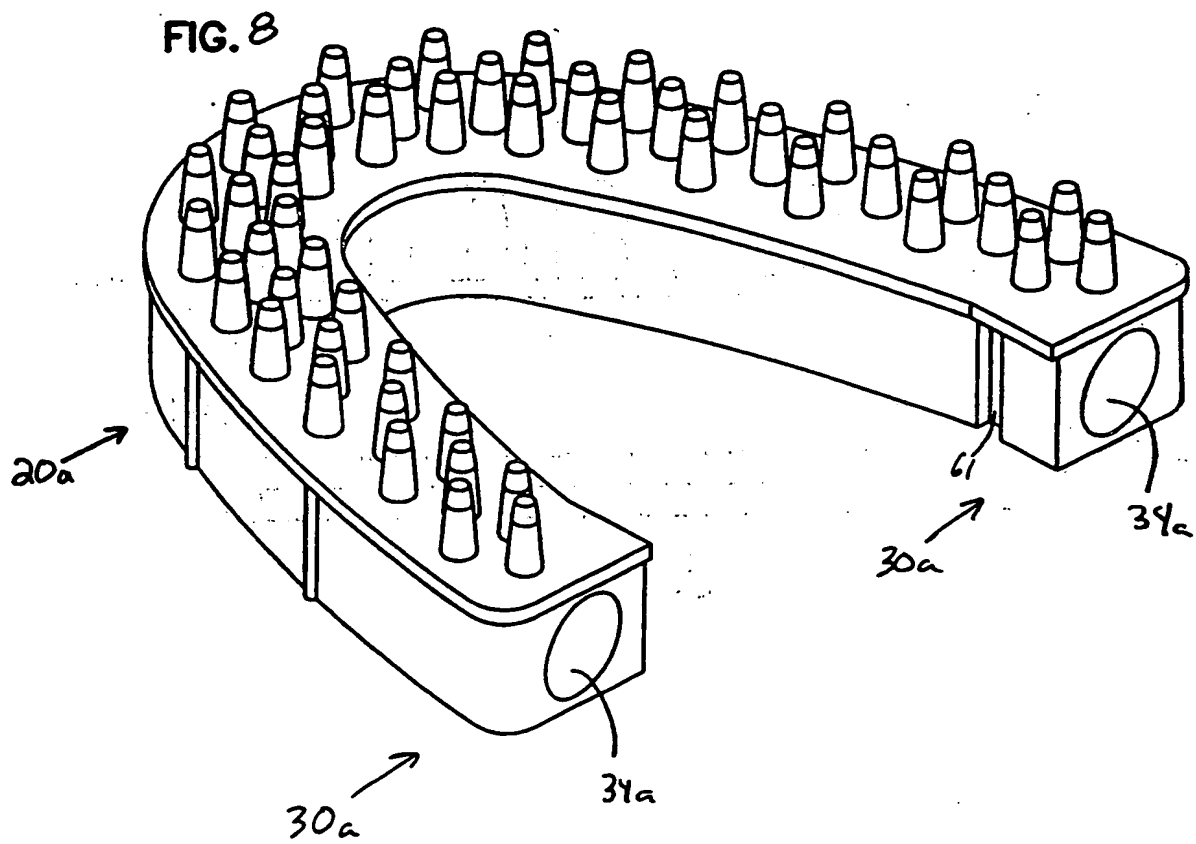


FIG. 7





9/11

FIG. 9

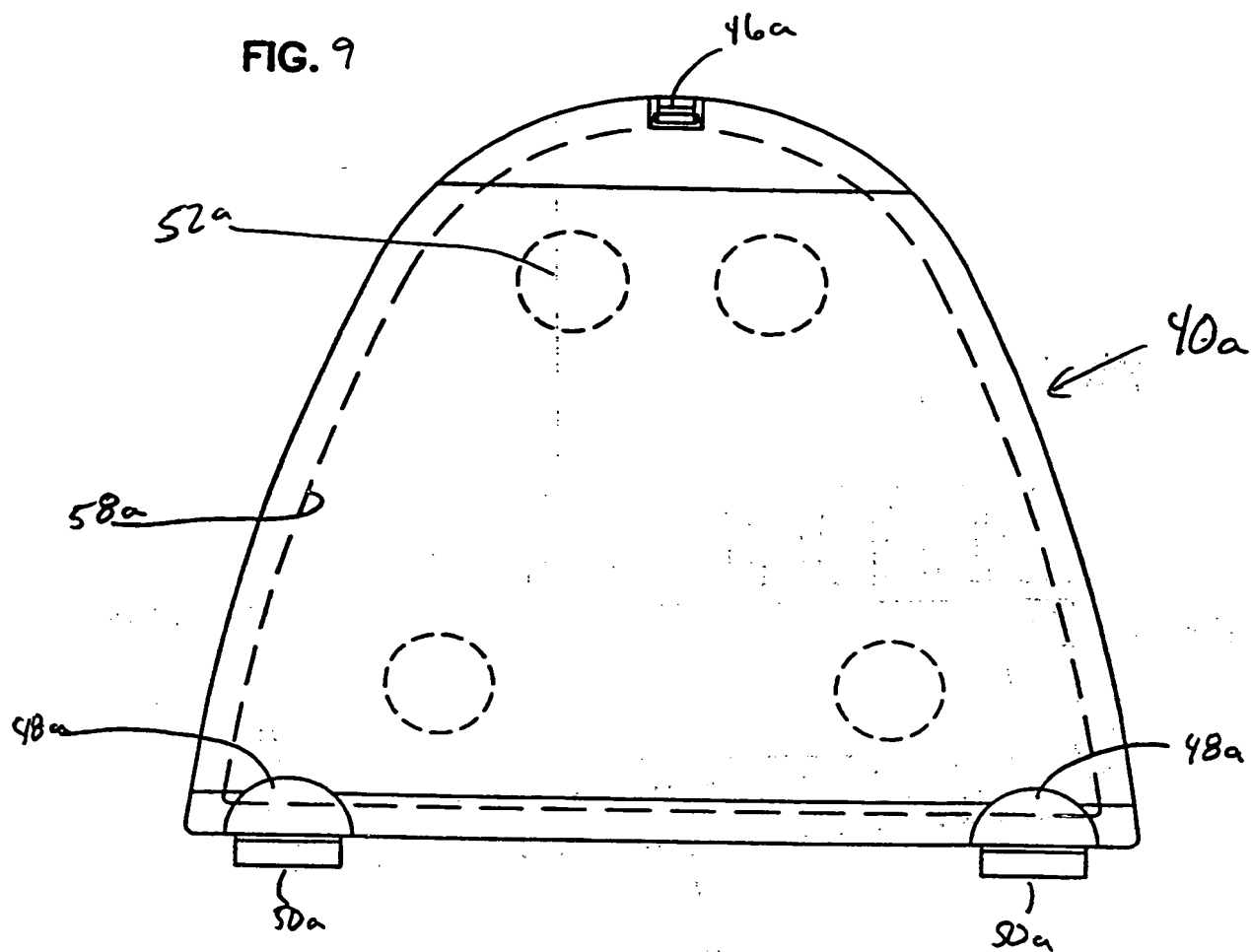
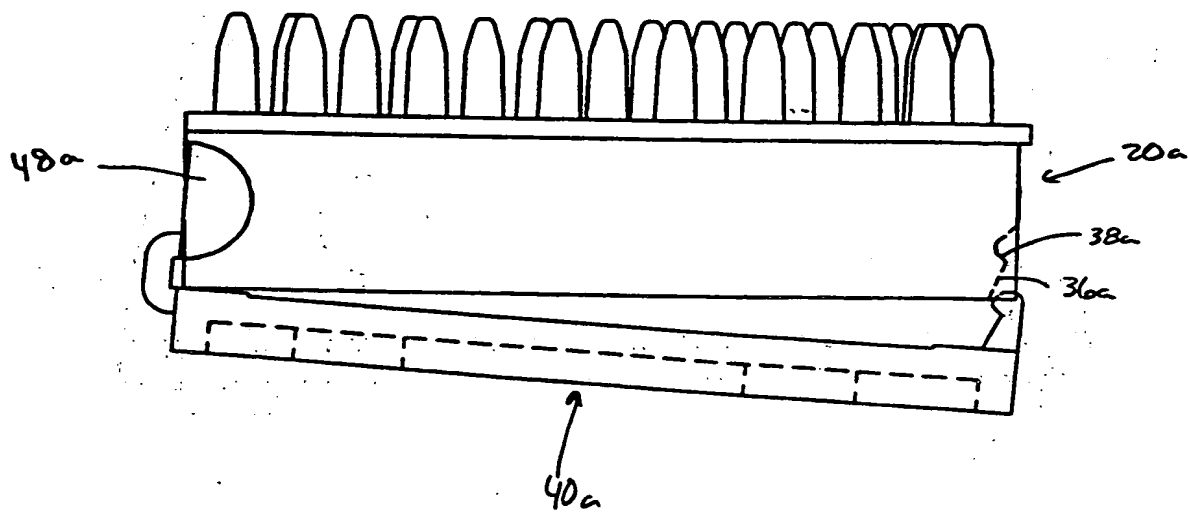
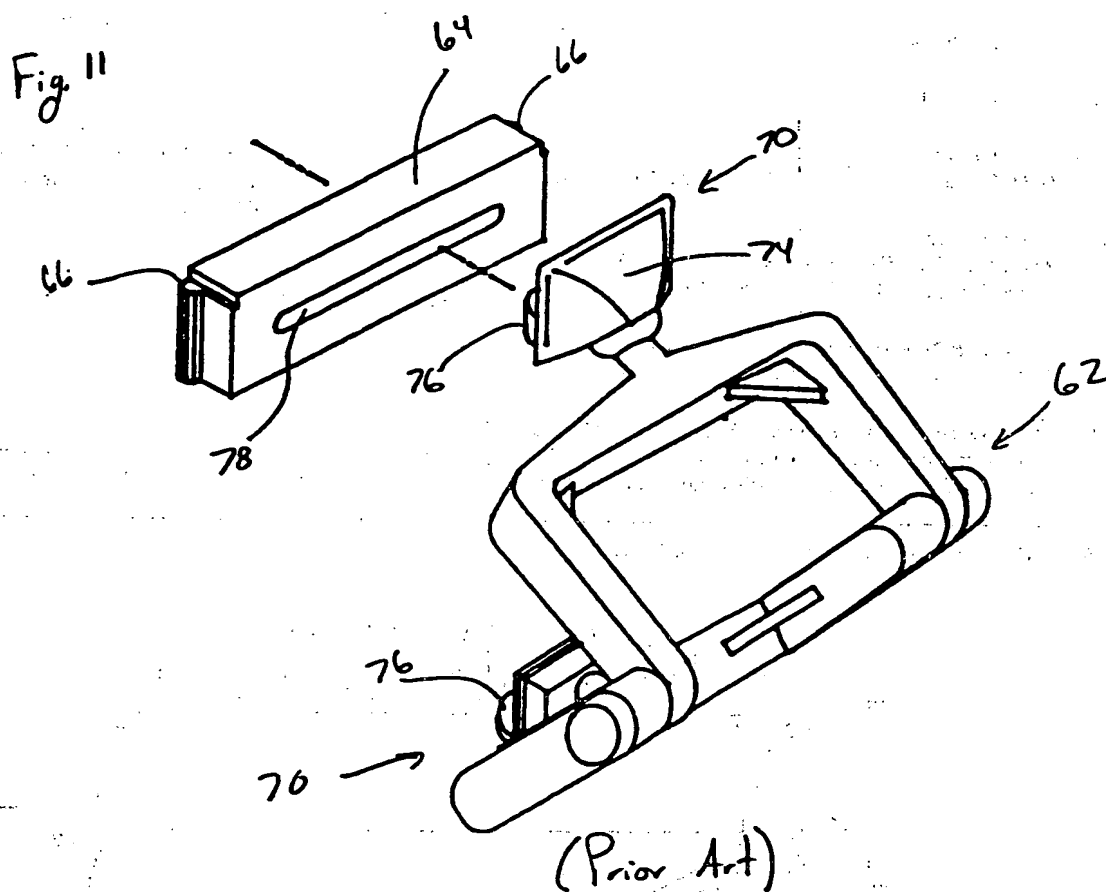




FIG. 10



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SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT,  
TZ, UA, UG, UZ, VN, YU, ZA, ZW.

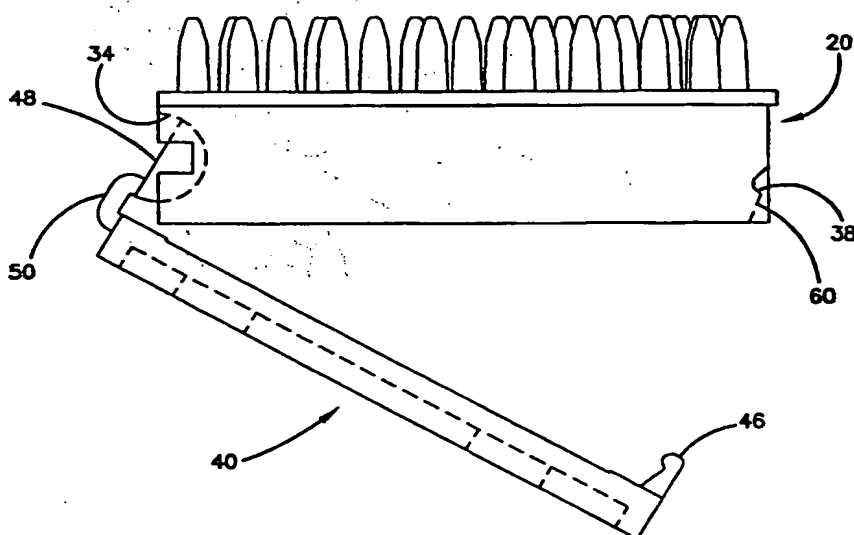
(84) Designated States (*regional*): ARIPO patent (GH, GM,  
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ning of each regular issue of the PCT Gazette.

(54) Title: DENTAL MODEL BASE ASSEMBLY



(57) Abstract: A premanufactured dental model base, and method, for supporting a cast dental model. The dental model base may be selectively connected to an articulator attachment plate which is adaptable for connecting the dental model base to a metal articulator. The same dental model base, at a user's option, may also be connected to a disposable articulator through a groove in the base that engages a disposable articulator tongue or by connecting a disposable articulator ball directly to a socket in the base. Thus, the dental model base may be conveniently used with either a metal articulator or a disposable articulator. In one embodiment, a concave socket at one end of the dental model base may engage an articulator ball or may engage the articulator attachment plate such that the attachment plate is detachably connected to the dental model base.

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# INTERNATIONAL SEARCH REPORT

International Application No

PC, JS 00/40326

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 A61C11/08 A61C9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 277 026 A (KV33 CORP) 3 August 1988 (1988-08-03) column 2, line 25 -column 3, line 23 column 5, line 11-53 figures 1-10	1,3,21
A	---	2,22
X	FR 2 750 851 A (GRAF ROBERT) 16 January 1998 (1998-01-16) page 2, line 9-33 page 4, line 10-25 figures 1-5	1,3,21
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	-/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

17 November 2000

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# INTERNATIONAL SEARCH REPORT

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 00/40326

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1, 2, 3, 21, 22, 27

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1, 2, 3, 21, 22, 27

Dental model base adapted to be directly connected to an articulator.

2. Claims: 4, 5, 6, 7, 12, 13, 14, 15, 16, 17, 18, 19, 20, 25, 26, 28

Dental model kit comprising an attachment plate or an attachment bar to modularly connect the dental model base to an articulator.

3. Claims: 8, 9, 10, 11, 23, 24

Pins for attaching a cast dental model to a model support surface.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PC JS 00/40326

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DENTAL MODEL BASE ASSEMBLY

(57) Abstract: A premanufactured dental model base, and method, for supporting a cast dental model. The dental model base may be selectively connected to an articulator attachment plate which is adaptable for connecting the dental model base to a metal articulator. The same dental model base, at a user's option, may also be connected to a disposable articulator through a groove in the base that engages a disposable articulator tongue or by connecting a disposable articulator ball directly to a socket in the base. Thus, the dental model base may be conveniently used with either a metal articulator or a disposable articulator. In one embodiment, a concave socket at one end of the dental model base may engage an articulator ball or may engage the articulator attachment plate such that the attachment plate is detachably connected to the dental model base.

WO 01/01881 A3

## **DENTAL MODEL BASE ASSEMBLY**

### **Background of the Invention**

This invention relates generally to a dental model base assembly and more particularly to such an assembly in which a premanufactured dental base may, at the  
5 option of a technician, be attached either to a disposable dental articulator or to a metal articulator.

Damaged teeth may be repaired or replaced by crowns, bridge inlays or other common dental prosthesis. A successful repair requires accurate alignment and visual uniformity of the repaired tooth with the patient's other teeth. Typically, a  
10 model is made of the patient's teeth and the prosthesis is fitted to the model and adjusted to achieve proper alignment and visual uniformity.

The model is typically formed by having a patient bite into a pliant casting material which cures to create a mold cavity having a negative impression of the patient's teeth and gums. The mold can be of all or any portion of the patient's  
15 gum line. A castable material is then poured into the negative impression to create a stone replica or dental model of the patient's teeth and gums.

To facilitate prosthesis development, the replica of the damaged tooth or teeth is severed from the remainder of the dental model. In one prior art system, severability is achieved by positioning the knurled end of a tapered dowel pin in the  
20 uncured stone material in correspondence with the damaged tooth or teeth. The dowel pin or pins must be carefully aligned and held in position which requires skill and time. Once the casting of the gum and teeth has hardened, the cured dental model is positioned adjacent an uncured dental model base which is held in a dental base mold. The tapered portion of the dowel pins protruding from the dental model  
25 are positioned in the uncured dental model base. To prevent bonding of the damaged tooth model with the dental model base, wax may be placed between the base and the dental model and around the tapered portion of the dowel pins associated with the damaged tooth model.

Once the dental model base has cured, a saw cut on each side of the  
30 damaged tooth model is made down to the dental model base which allows removal of the damaged tooth model and the attached dowel from the rest of the dental model.

After the damaged tooth model is removed, the prosthesis can be fitted and adjusted without the spacial limitations encountered when the damaged tooth

model is joined to the full dental model. After the prosthesis is made and attached to the dental model segment, the tapered dowel attached to the dental model segment is guided into its respective aperture in the dental model base which guides the dental model segment to its position in the dental model. Alignment and visual conformity are then assessed.

Alignment is ascertained by evaluating the registration of the repaired tooth with the dental model of the patient's opposing teeth. This is achieved by connecting the upper and lower dental model to an articulator. If the prosthesis is out of alignment or does not visually conform to the rest of the patient's teeth, the dental model segment containing the damaged tooth can be removed, adjusted and returned to the dental model base. This process is repeated until proper alignment and visual conformity is achieved. Thus, the model of the damaged tooth may be removed and inserted into the base repeatedly. This repeated removal and reinsertion can damage the fit of the tapered portion of the dowel pin within the cast dental model base which decreases the accuracy of the alignment procedure.

Several plastic dental model bases exist. Examples are described in U.S. Patent No. 5,788,489. These plastic bases facilitate mounting a cast dental model and overcome some of the difficulties inherent in cast dental model bases. However, plastic bases must also be attached to articulators.

The Vertex<sup>®</sup> articulator is one disposable articulator typically used to check the alignment of repaired teeth. The Vertex<sup>®</sup> articulator has a ball and socket joint that permits alignment of the articulator with dental model bases supporting a variety of different dental models. The Vertex<sup>®</sup> articulator socket member is formed with a tongue opposite the socket. The tongue is typically glued to a slot in the rear portion of the cast dental model bases. The Vertex<sup>®</sup> articulator may also be glued to slots formed in plastic dental model bases. An example is depicted in FIG. 9 of U.S. Patent No. 5,788,489.

Other common articulators are metal and the dental model is attached semi-permanently by applying a bonding agent, such as plaster, to the dental model base and the articulator. An example is depicted in FIG. 15 of U.S. Patent No. 5,788,489. While metal articulators may be separated at the hinge, protruding portions of the articulator obstruct access to the dental model from certain directions. A technician may prefer using one type of articulator in certain circumstances and the other when the circumstances are different.

### Summary of the Invention

The present invention is directed to a significant improvement to the invention disclosed in U.S. Patent No. 5,788,489. This invention provides the technician with a unique dental model base assembly that can be used with a variety of articulators types. Thus, increasing the accuracy of the adjustment of the dental model.

In one embodiment of the invention a premanufactured dental model base includes a dental model base body with a dental model support surface. The base body has a wall extending from the dental model support surface. The base body has a first end and a second end, and one of the ends has a socket adapted to engage a ball.

Another embodiment includes a dental model kit that includes, a dental model base that has a socket at a first end and a dental model base coupling at a second end, and an articulator attachment plate. The articulator attachment plate has a ball connected to an attachment plate first end and an attachment plate coupling at an attachment plate second end. The attachment plate coupling is adapted to engage the dental model base coupling. The ball is adapted to slidably engage the socket.

Another embodiment includes a dental model base assembly that includes a dental model base body with a spherical concavity in a first end and a base body connector at a second end and an attachment plate. The attachment plate is disengably connected to the dental model base body connector. The attachment plate has a spherical convex element for engaging the spherical concavity.

Another embodiment includes a method comprising the steps of slidably engaging a ball at a first end of an attachment plate with a socket at a first end of a dental model base. The next step is pivoting the attachment plate relative to the dental model base about the ball and socket. The next step is slidably engaging a connector on the attachment plate with a receiver at the base body second end where the sliding engagement creates a bias between the ball and the connector. The final step is fully engaging the connector with the receiver such that the attachment plate is securely and detachably connected to the dental model base.

Another embodiment includes a premanufactured dental model base that includes dental model base body that has a molar end and an incisor end opposite the molar end. The molar end has a spherical socket sized and positioned

to detachably engage a round portion of an articulator attachment plate or to fixedly connect to a round portion of an articulator.

Another embodiment includes a premanufactured dental model base that includes a dental model support surface and a plurality of tapered pins protruding from the support surface. The pins being of the same material as the base and are formed with the base. A wall adjacent the dental model support surface the wall having a round depression at one end of the dental model base.

Another embodiment includes dental model base that includes a dental model support surface that has a first end and a wall adjacent the dental model support surface. The wall has a socket formed adjacent the dental model support surface first end. The socket being engagably at a user's option with either a ball connected to an articulator or with a round portion of an articulator attachment plate

Another embodiment includes an articulator attachment plate that includes an articulator attachment side. The articulator attachment side has plaster retaining protrusions, a dental model side opposite the articulator attachment side, a first and second end, a ball supporting member extending from the dental model side at the first end, a round protrusion extending from the ball supporting member remote from the dental model side, and a hook extending from the dental model attachment side at the second end.

Another embodiment includes a premanufactured dental model base that includes a dental model base body that has a dental model support surface. The base body has a wall extending from the dental model support surface. The base body has a first end and a second end. One of the ends has a ball adapted to engage a socket.

Another embodiment includes a full arch dental model base that includes a dental model support surface. The dental model support surface has an outer perimeter generally following the curvature of a patient's gum, a first end of the support surface corresponding generally to the location of incisors on the gum, and a wall extending from the support surface. The wall being generally perpendicular to the support surface. A connector at the first end of the dental model base. The dental model has a second end remote from the first end. The second end has a first side and a second side. A first concavity at the second end first side and a second concavity at the second end second side. An articulator attachment bar is interposed between the second end first side and the second end second side. The articulator attachment bar has a groove for engaging an articulator tongue.

### **Brief Description of the Drawings**

Figure 1 is a right side, rear and top perspective view of a quadrant dental model base.

Figure 2 is a front elevation view of a quadrant dental model base.

5        Figure 3 is a side elevation view of an attachment plate for a quadrant dental model base.

Figure 4 is a top plan view of an attachment plate for a quadrant dental model base.

10       Figure 5 is a side elevation view of the attachment plate and quadrant dental model base.

Figure 6 is a side elevation view of the attachment plate partially engaged with the quadrant dental model base.

Figure 7 is a side elevation view of the attachment plate fully engaged with the quadrant dental model base.

15       Figure 8 is a right side, rear and top perspective view of a full arch dental model base.

Figure 9 is a top plan view of an attachment plate for a full arch dental model base.

20       Figure 10 is a side elevation view of the attachment plate partially engaged with the full arch dental model base.

Figure 11 is a perspective view of a typical disposable articulator used with the invention.

### **Detailed Description of the Preferred Embodiment**

25       FIG. 1 depicts a quadrant dental model base 20 according to one embodiment of the present invention. In this embodiment, a clear acrylic plastic is preferred, however, many other materials may be used. As shown in FIG. 1, the dental model base 20 has a model support surface 22. The shape of the dental model support surface 22 follows the general contours of half of a normal gum.

30       In this embodiment a plurality of tapered pins 24 are formed with the dental model base 20. The pins 24 are formed of the same material as the base 20 and the base 20 and pins 24 form one integral body. The pins 24 extend from the dental model support surface 22. The pins may releasably engage a cast dental model. Features of the present invention may be adapted to other premanufactured base designs such as those described in U.S. Patent Nos. 5,788,489.

A wall 26 extends from the dental model support surface 22 opposite the pins 24. The wall 26 generally follows the periphery of the dental model support surface 22.

5 The front 28 of the dental model base 20 is configured to support the front of a dental model. In other words, the pins 24 at the front 28 of the base 20 should align generally with the casting of a patient's incisors.

The rear 30 of the base 20 is configured to support the rear of a dental model. In other words, the pins 24 at the rear 30 of the base 20 should align generally with the casting of the patient's molars.

10 The rear 30 of the base 20 has an articulator attachment groove 32 formed across a socket 34. The socket 34 defines a hemispheric void.

As shown in FIG. 2, the front 28 of the base 20 has a recess 36 forming a notch 38.

15 FIGS. 3 and 4 show an attachment plate 40. The attachment plate 40 has an articulator attachment side 42 and a base engagement side 44. A hook 46 is at one end of the attachment plate 40. A hemisphere or ball 48 is connected to the opposite end of the attachment plate 40 by a hemisphere connecting member 50.

20 The attachment plate 40 has two posts 52 positioned in a void on the articulator attachment side 42 of the attachment plate 40. The posts are tapered slightly such that the base of each post 54 has a smaller diameter than the head of the post 56. Also, the walls 58 defining the void on the articulator attachment side 42 of the attachment plate 40 are tapered such that the walls 58 are thicker at the articulator attachment side surface 42 than at the base of the void. The tapered posts 52 and walls 58 aid in securing the attachment plate 40 to a typical metal articulator.

25 The attachment plate 40 is connected to the base 20 by placing the hemisphere or ball 48 in the socket 34 formed in the rear 30 of the base 20, as shown in FIG. 5. The attachment plate 40 is then rotated about the ball 48 and socket 34 relative to the base 20.

30 As shown in FIG. 6, the hook 46 slidingly engages the recess 36 in the base 20. As pressure is applied to join the base 20 and attachment plate 40, the hook 46 slides along the inclined plane 60 of the recess 36. When the attachment plate 40 is properly engaged with the base 20, as shown in FIG. 7, the hook 46 engages the recess notch 38 and secures the attachment plate 40 to the base 20.

35 Figure 8 depicts a base 20a configured to support a full arch dental model. As shown, the full arch base 20a has two sockets 34a at the rear 30a of the

base 20a. Figure 9 depicts an articulator attachment plate 40a for a full arch dental model base. The attachment plate 40a has tapered posts 52a and tapered walls 58a for securing the plate to a metal articulator. Two hemisphere connecting members 50a connect a pair of hemispheres or balls 48a to the rear of plate 40a. A hook 46a extends from the front of the plate. Two vertical slots 61 are located near the rear of the full arch base 20a.

As depicted in FIG. 10, the full arch base 20a has a recess 36a and notch 38a. A full arch attachment plate 40a is connected to a full arch base 20a by inserting two full arch attachment plate balls 48a into the two full arch base sockets 24a and thereafter preceding as described above.

The full arch base 20a may be connected to a disposable articulator 62 by sliding an articulator attachment bar 64 into the vertical slots 61. As shown in FIG. 11, the attachment bar has two flanges 66 that slidingly engage the vertical slots 61. The articulator 62 is defined by a flexible hinge and a pair of ball and socket joints 70. The articulator ball 72 engages an articulator socket 74 which may be attached to a base by inserting an articulator tongue 76 into a groove 78 in an articulator attachment bar 64. It was also known to insert the tongue 76 into a groove in a cast base.

If a technician chooses to use a metal articulator, he or she may connect an articulator attachment plate to a dental model base as described above. Plaster may then be used to secure the plate to the metal articulator.

If the technician chooses to use a disposable articulator, the technician may simply insert the articulator tongue 76 into the groove 32 at the rear of the quadrant base 20. If a full arch base is used, the tongue 76 can be inserted into the articulator attachment bar groove 78 after the attachment bar 64 is fixed to the full arch base 20a.

Alternatively, the technician may remove the disposable articulator socket 74 and place the articulator ball 72 directly in the socket 34 at the rear of the base 20.

The foregoing describes various embodiments of the claimed invention. The claimed inventions are not limited to the embodiments described above. For example, it is contemplated that the principles of the invention described above can be applied to numerous different dental model base designs. It is also contemplated that a socket could be formed in a disposable articulator that would



engage a ball formed at the rear of the dental model base. Numerous other alternative constructions exist that fall within the scope of the claimed invention.

**I CLAIM:**

1. A premanufactured dental model base comprising:  
a dental model base body, said dental model base body having a dental model  
5 support surface;  
said base body having a wall extending from said dental model support  
surface;  
said base body having a first end and a second end, and one of said ends  
having a socket adapted to engage a ball.  
10
2. The dental model base of claim 1 wherein:  
said dental model base body has a slot at one of said ends adapted to engage  
a disposable articulator.
- 15 3. The dental model base of claim 1 wherein:  
said socket is adapted to engage a ball connected to a disposable articulator.
4. The dental model base of claim 1 wherein:  
said socket is adapted to engage an articulator attachment plate.  
20
5. The dental model base of claim 1 wherein:  
said socket is a first socket;  
said dental model support surface is adapted to support a full arch dental  
model;  
25 said first end of said dental model base body corresponds to the molar  
portion of said full arch dental model;  
said first end having a first side corresponding to the left molars on the dental  
model and a second side corresponding to the right molars on the dental model; and  
said dental model base body having said first socket on said first side of said  
30 first end and a second socket on said second side of said first end.
6. The dental model base of claim 5 further comprising:  
an articulator attachment bar;

said articulator attached bar interposed between said dental model base body first end first side and said dental model base body first end second side.

5 7. The dental model base of claim 6 wherein:  
said attachment bar is slidingly engageable with said dental model base body.

8. The dental model base of claim 1 wherein:  
said dental model base has a plurality of integral pins protruding from said  
10 dental model support surface; and  
said pins adapted to slidingly engage a cast dental model.

9. The dental model base of claim 1 wherein:  
a plurality of apertures pass through said dental model support surface and  
15 said dental model base.

10. The dental model base of claim 9 wherein:  
said apertures are adapted to engage pins connected to a dental model.

20 11. The dental model base of claim 9 wherein;  
said apertures are adapted to form stone dowels; and  
said stone dowels formed with said dental model.

25 12. A dental model kit comprising:  
a dental model base;

said dental model base having a socket at a first end and a dental  
model base coupling at a second end; and  
an articulator attachment plate;  
said articulator attachment plate having a ball connected to an  
30 attachment plate first end and an attachment plate coupling at an attachment  
plate second end wherein said attachment plate coupling is adapted to engage  
said dental model base coupling and said ball is adapted to slidably engage  
said socket.

13. The dental model kit of claim 12 further comprising:  
an articulator attachment bar.
14. The dental model kit of claim 12 further comprising a disposable articulator.
- 5 15. A dental model base assembly comprising:  
a dental model base body, said dental model base body having spherical  
concavity in a first end and a base body connector at a second end; and  
an attachment plate;  
10 said attachment plate disengably connected to said dental model base  
body connector;  
said attachment plate having a spherical convex element engaging  
said spherical concavity.
- 15 16. The dental model assembly of claim 15 wherein:  
said spherical convex element is biased to secure said attachment plate to  
said dental model base body.
17. A method comprising the steps of:  
20 slidingly engaging a ball at a first end of an attachment plate with a socket at  
a first end of a dental model base;  
pivoting said attachment plate relative to said dental model base about said  
ball and socket;  
slidingly engaging a connector on said attachment plate with a receiver at  
25 said base body second end wherein said sliding engagement creates a bias between  
said ball and said connector; and  
fully engaging said connector with said receiver such that said attachment  
plate is securely and detachably connected to said dental model base.
- 30 18. The method of claim 17 wherein:  
said full engagement of said connector with said receiver releases a portion  
of said bias.
19. The method of claim 17 wherein:

said engagement releases substantially all of said bias.

20. The method of claim 17 additionally comprises the step of connecting said articulator attachment plate to an articulator.

5

21. A premanufactured dental model base comprising:  
a dental model base body;  
said dental model base body having a molar end and an incisor end opposite  
said molar end;

10 said molar end having a spherical socket sized and positioned to detachably engage a round portion of an articulator attachment plate or to fixedly connect to a round portion of an articulator.

22. The premanufactured dental model base of claim 21 wherein:  
15 said base has a slot at said molar end;  
said slot sized and positioned to receive a tongue connected to an articulator.

23. A premanufactured dental model base comprising:  
a dental model support surface;  
20 a plurality of tapered pins protruding from said support surface;  
said pins being of the same material as said base, said pins formed with said base; and  
a wall adjacent said dental model support surface said wall having a round depression at one end of said dental model base.

25

24. The premanufactured dental model base of claim 23 wherein:  
said round depression is a socket;  
said dental model base has a second end remote from said first end; and  
said dental model base has a receiver at said second end.

30

25. A dental model base comprising:  
a dental model support surface;  
said dental model support surface having a first end;  
a wall adjacent said dental model support surface, said wall having a socket  
35 formed adjacent said dental model support surface first end said socket being

engagably at a user's option with either a ball connected to an articulator or with a round portion of an articulator attachment plate.

26. An articulator attachment plate comprising:

- 5 an articulator attachment side, said articulator attachment side having plaster retaining protrusions;  
a dental model side opposite said articulator attachment side;  
a first and second end;  
a ball supporting member extending from said dental model side at said first  
10 end;  
a round protrusion extending from said ball supporting member remote from said dental model side; and  
a hook extending from said dental model attachment side at said second end.

15 27. A premanufactured dental model base comprising:

- a dental model base body, said dental model base body having a dental model support surface;  
said base body having a wall extending from said dental model support surface;  
20 said base body having a first end and a second end, one of said ends having a ball adapted to engage a socket.

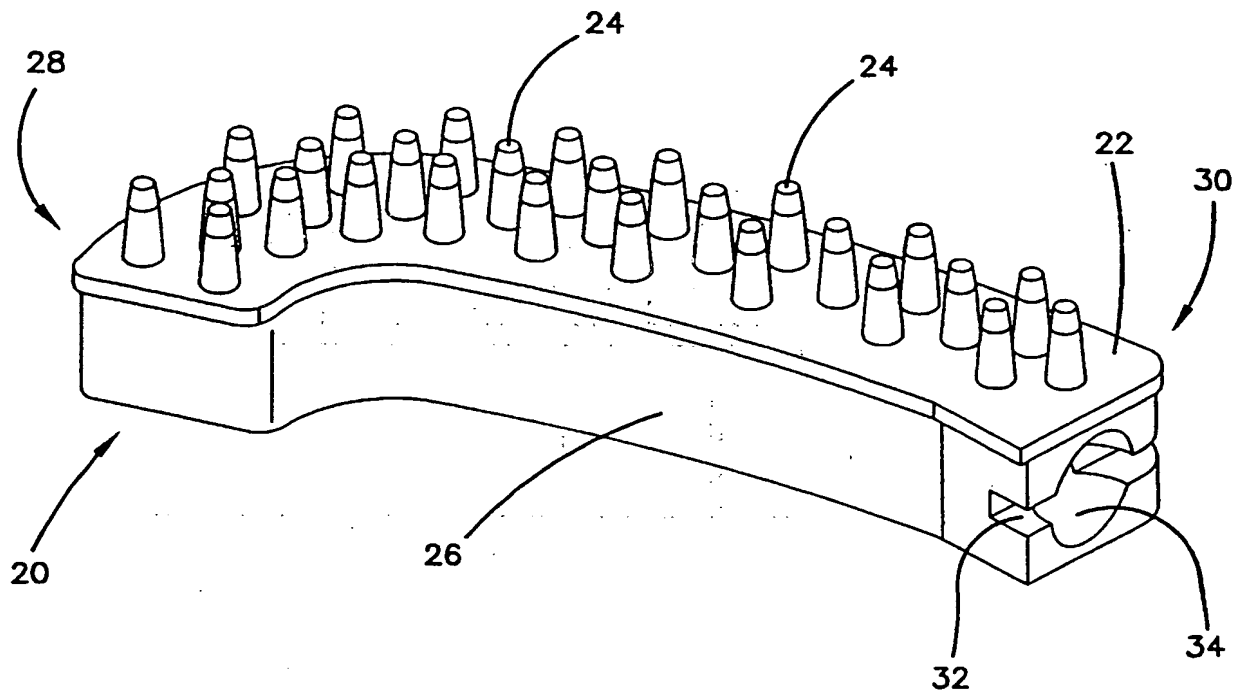
28. A full arch dental model base comprising:

- 25 a dental model support surface;  
said dental model support surface having an outer perimeter generally following the curvature of a patient's gum;  
a first end of said support surface corresponding generally to the location of incisors on said gum;  
30 a wall extending from said support surface, said wall being generally perpendicular to said support surface;  
a connector at said first end of said dental model base;  
said dental model having a second end remote from said first end, said second end having a first side and a second side;

a first concavity at said second end first side and a second concavity at said second end second side;

an articulator attachment bar interposed between said second end first side and said second end second side said articulator attachment bar having a groove for  
5 engaging an articulator tongue.

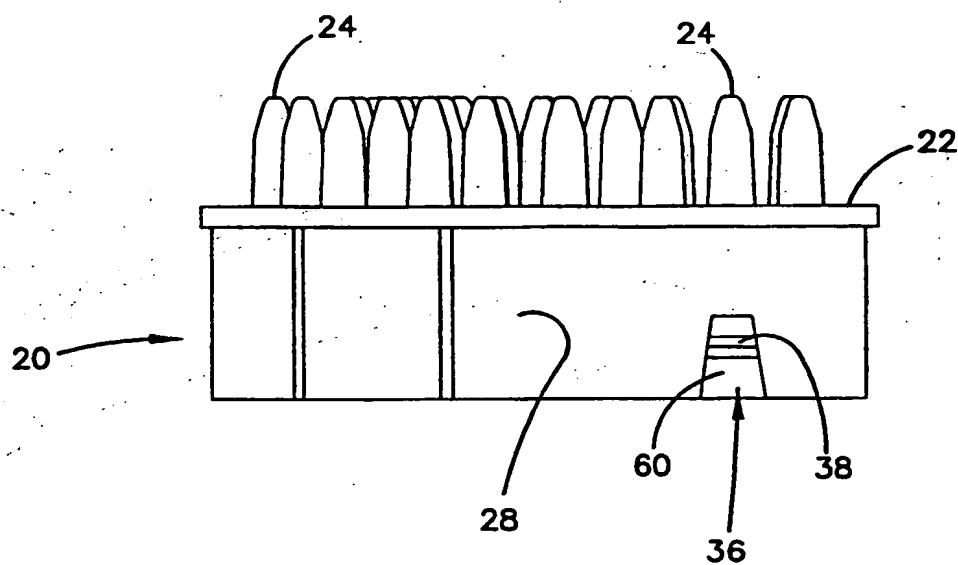
FIG. 1



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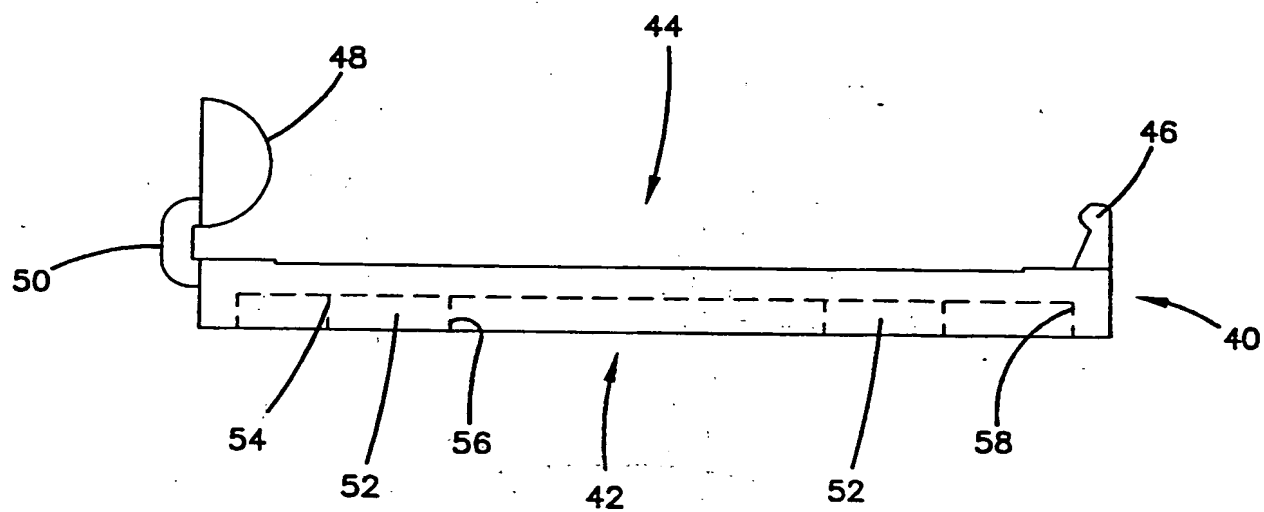
FIG. 2



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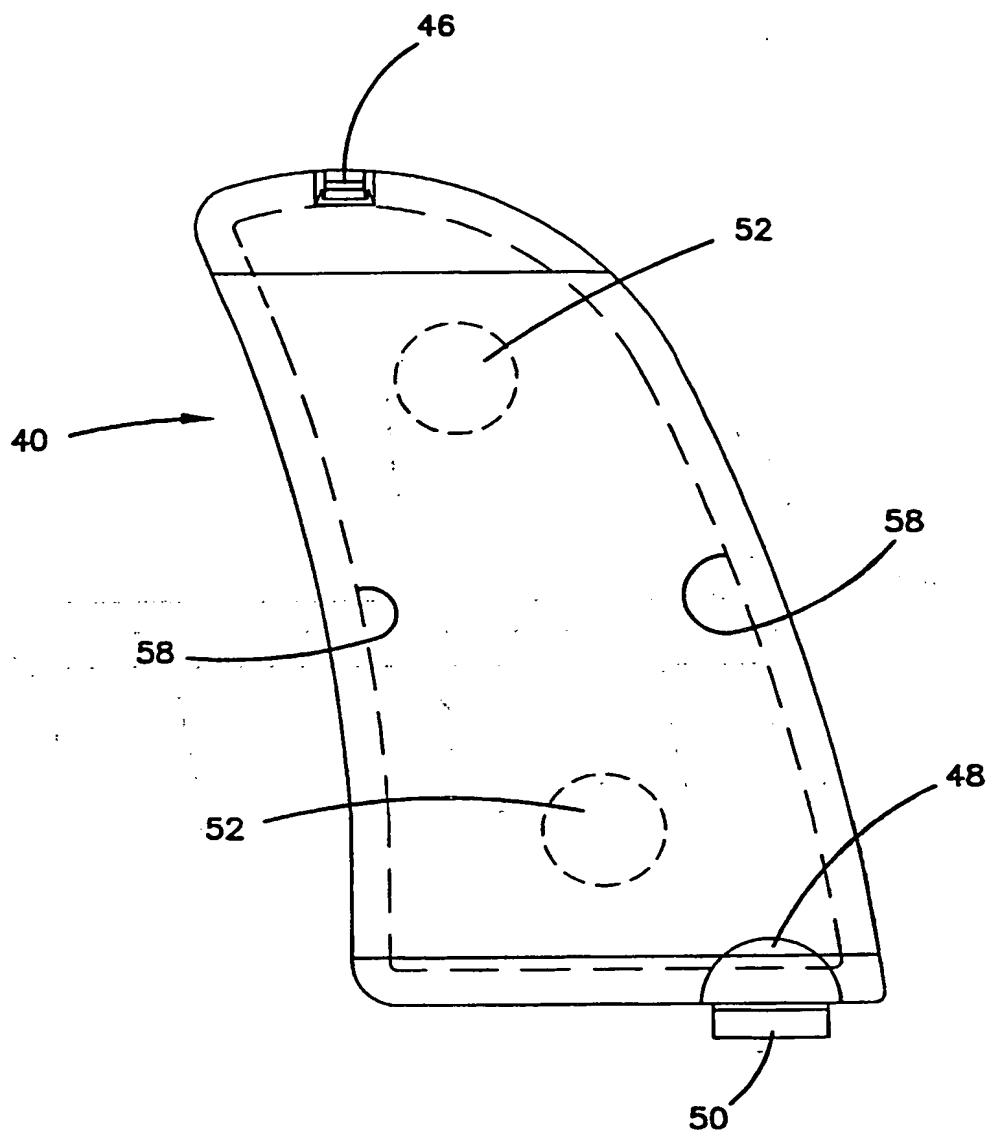
FIG. 3



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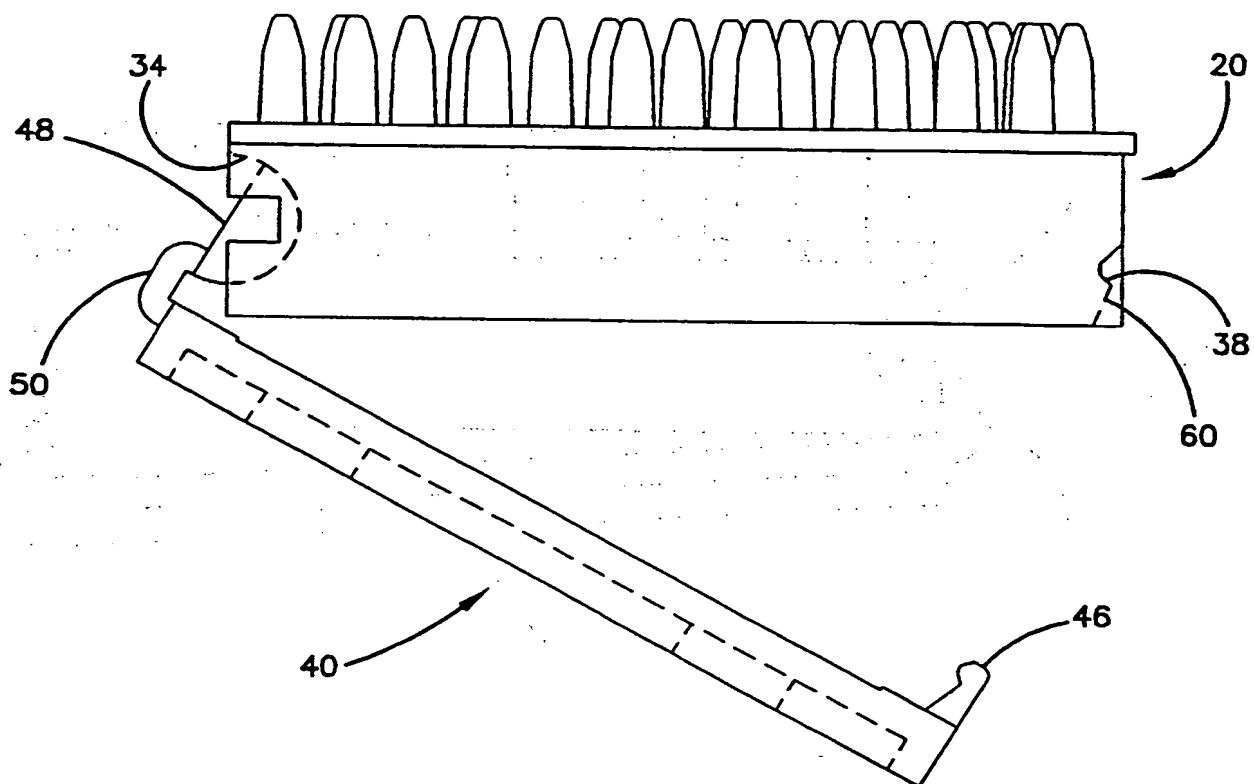
FIG. 4



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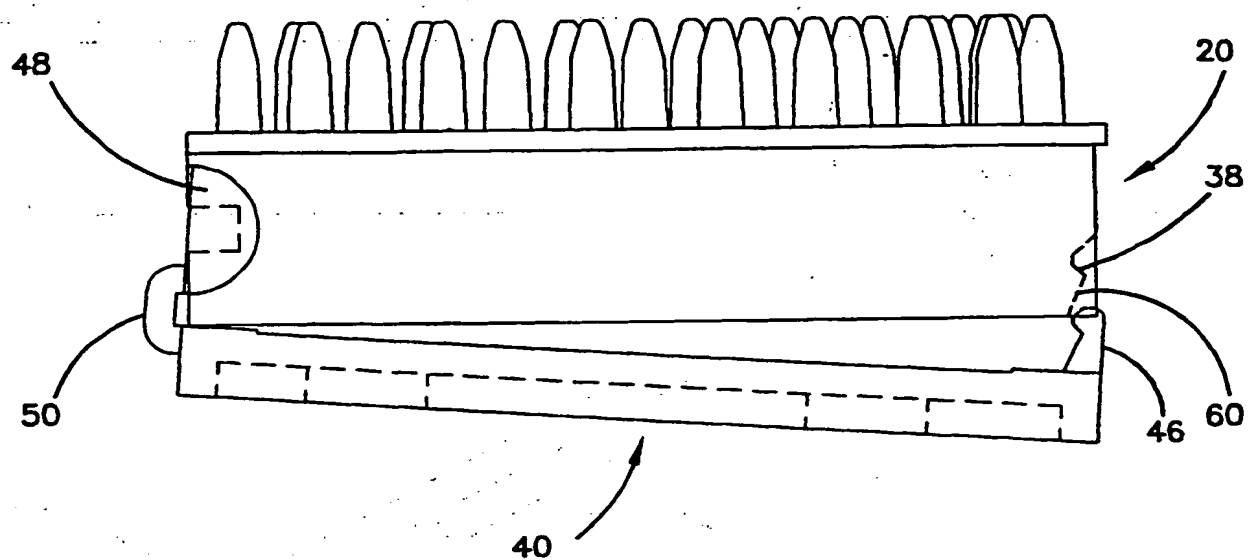
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FIG. 5



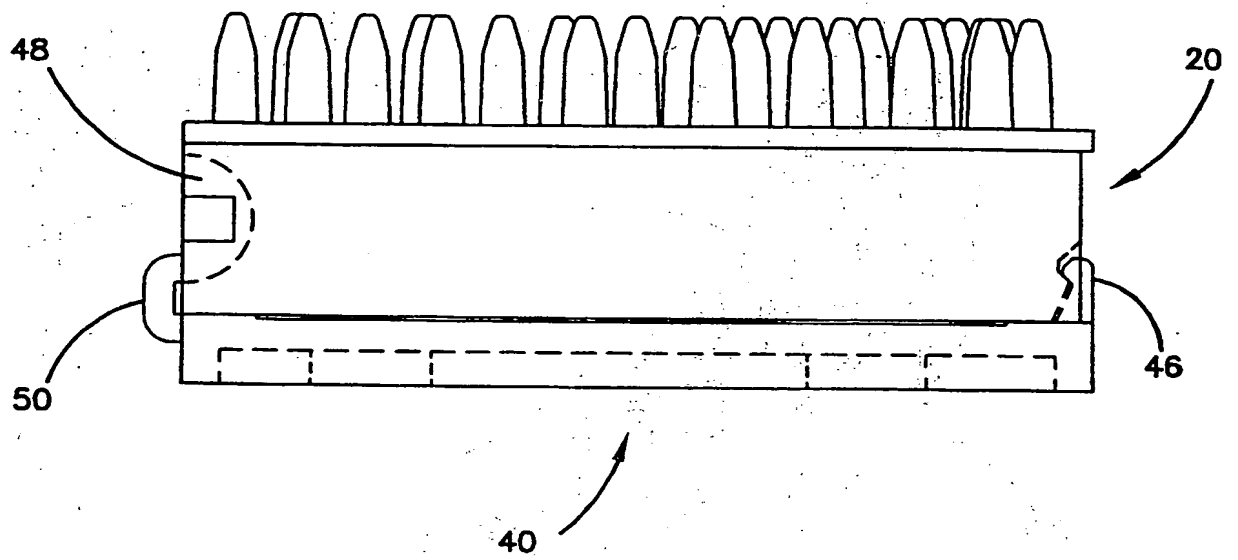
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FIG. 6



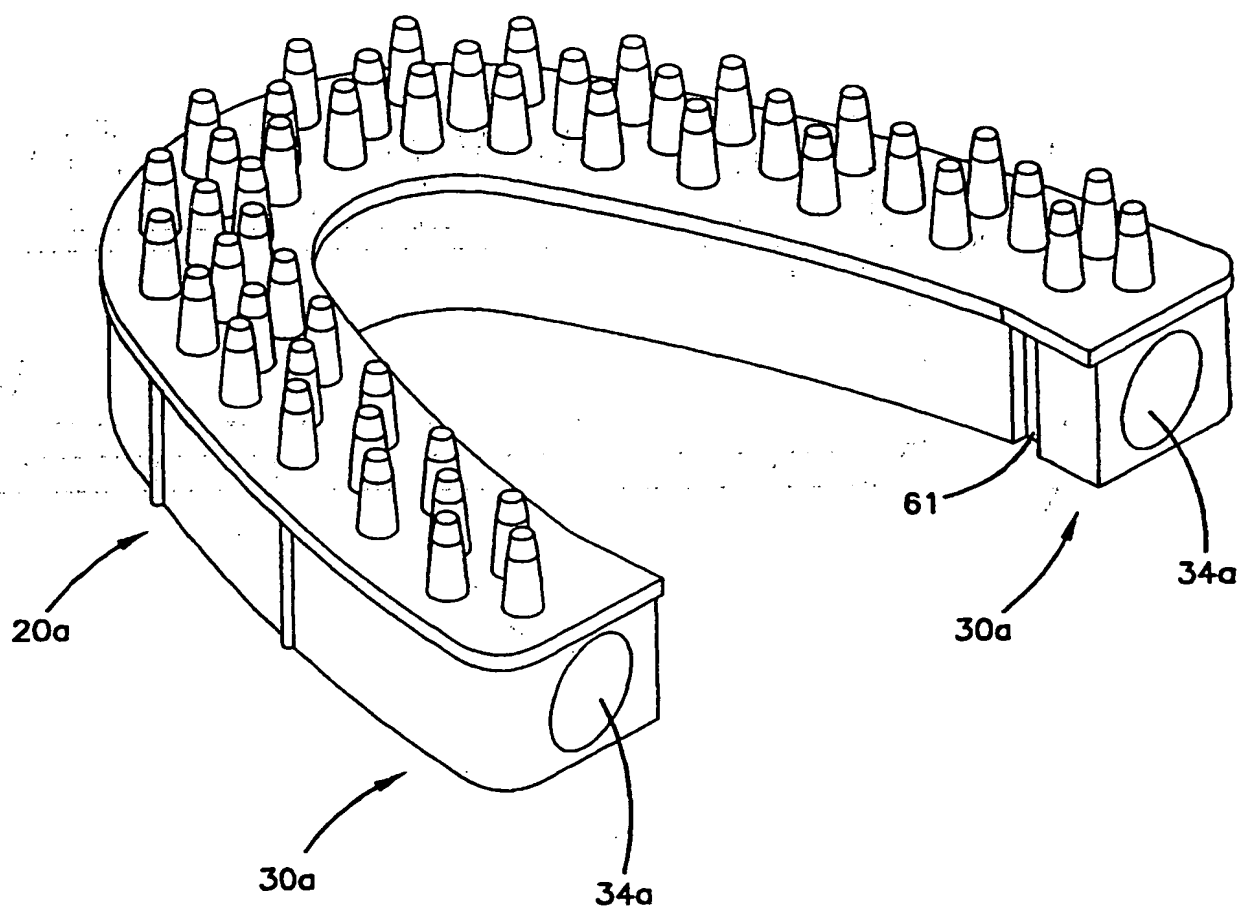
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FIG. 7



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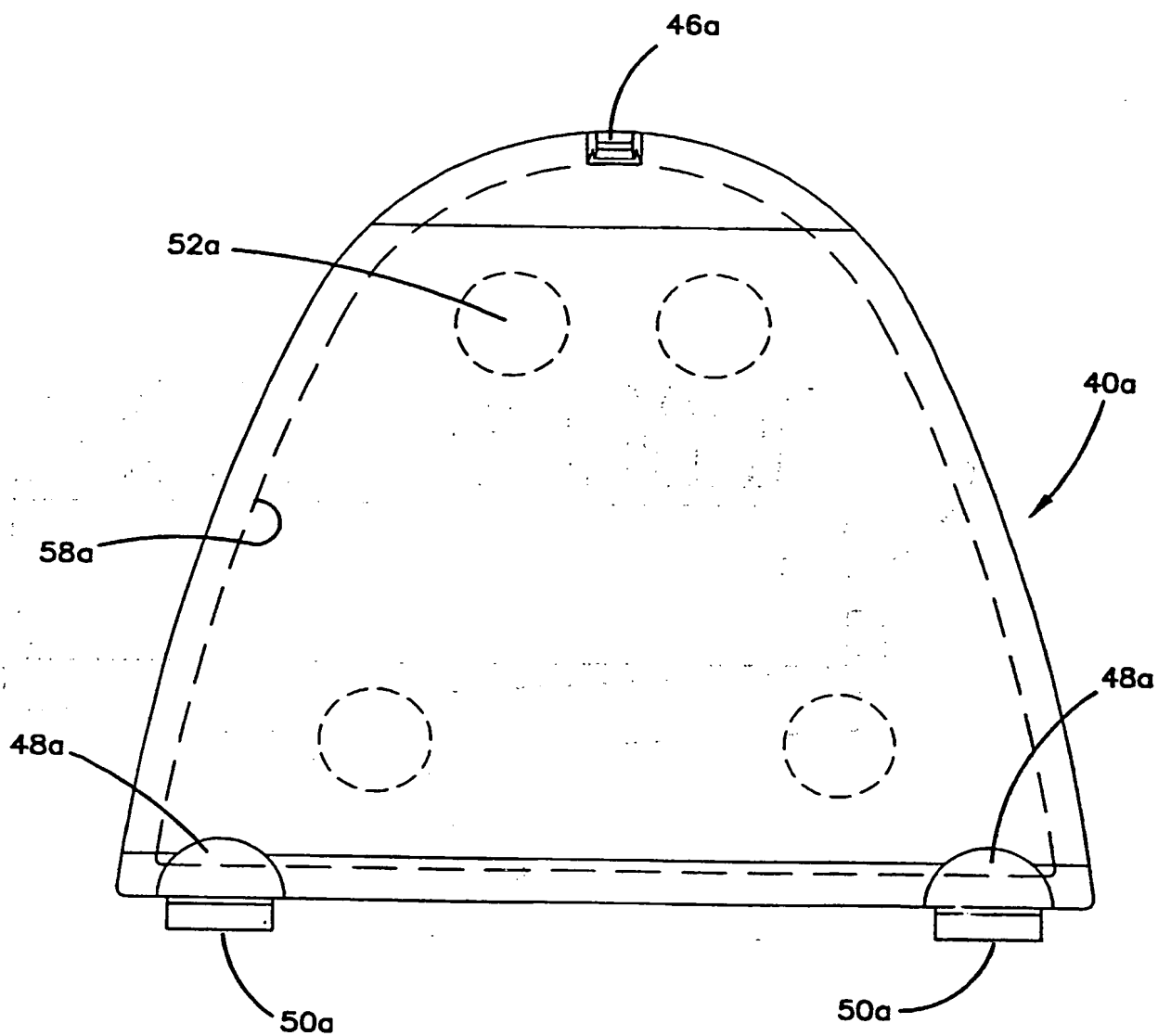
FIG. 8



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9/11

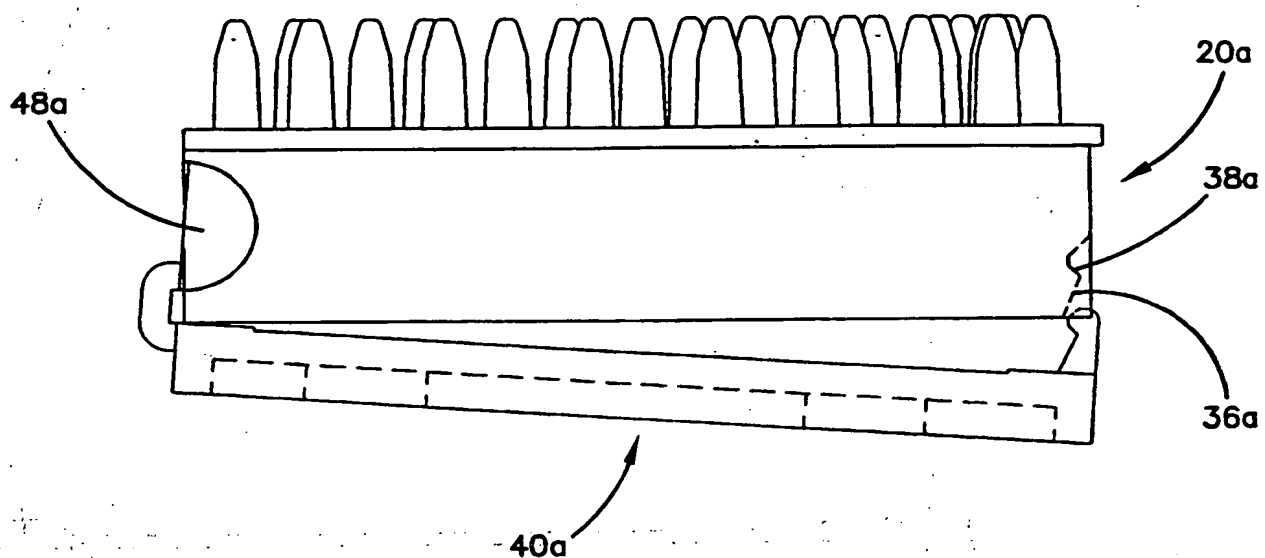
FIG. 9



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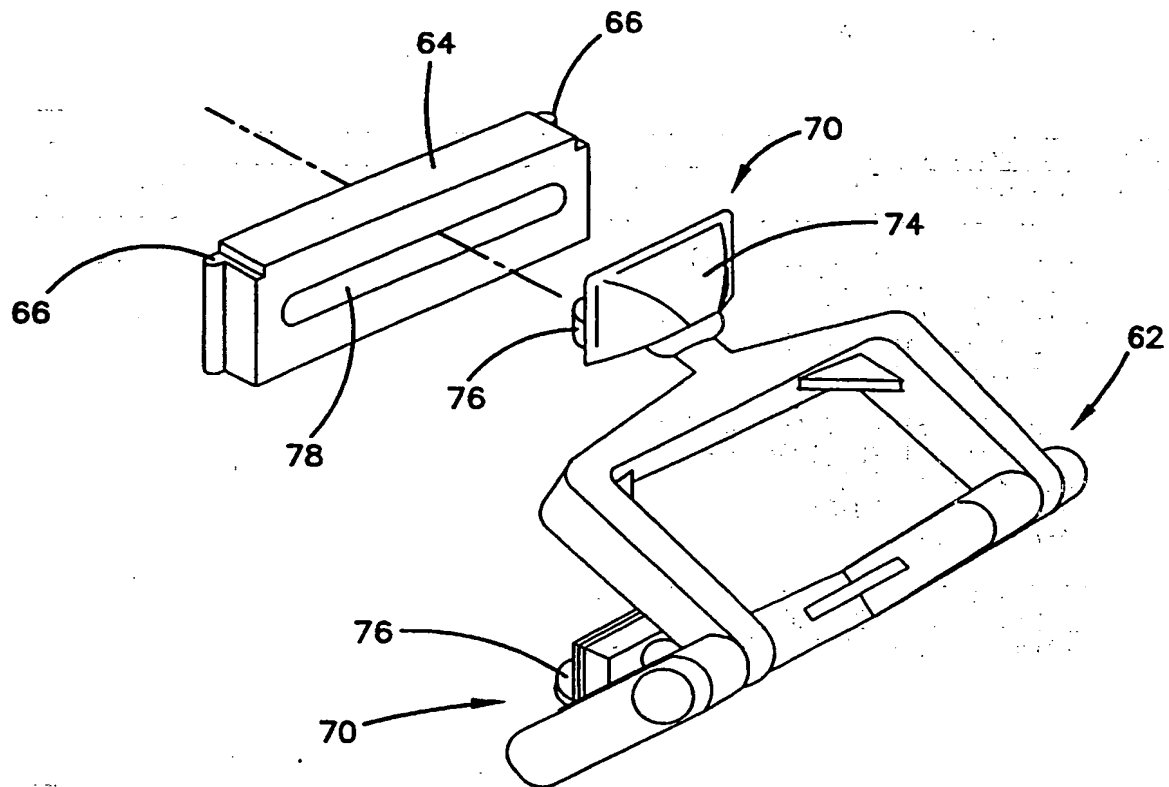
FIG. 10



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11/11

FIG. 11 (Prior Art)



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## INTERNATIONAL SEARCH REPORT

International Application No

PCT, JS 00/40326

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61C11/08 A61C9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 277 026 A (KV33 CORP) 3 August 1988 (1988-08-03) column 2, line 25 - column 3, line 23 column 5, line 11-53 figures 1-10	1,3,21 2,22
X	FR 2 750 851 A (GRAF ROBERT) 16 January 1998 (1998-01-16) page 2, line 9-33 page 4, line 10-25 figures 1-5	1,3,21
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search

17 November 2000

Date of mailing of the international search report

19.03.01

Name and mailing address of the ISA

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Salvignol, A

## INTERNATIONAL SEARCH REPORT

Internatinnal Application No

PC, JS 00/40326

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 769 634 A (CHOI JOHN) 23 June 1998 (1998-06-23) column 2, line 37 -column 3, line 35; figures 1-9	27
A	--- US 5 766 007 A (HUFFMAN RONALD E) 16 June 1998 (1998-06-16) column 5, line 19-41; figures 1-10	1,2,22
A	--- US 5 788 489 A (HUFFMAN RONALD E) 4 August 1998 (1998-08-04) cited in the application column 1, line 3-8 column 3, line 16-50 column 5, line 3-36 column 6, line 47 -column 8, line 18 figures 1-16 -----	1-3,21, 22,27

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 00/40326

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1, 2, 3, 21, 22, 27

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.  
☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1, 2, 3, 21, 22, 27

Dental model base adapted to be directly connected to an articulator.

2. Claims: 4, 5, 6, 7, 12, 13, 14, 15, 16, 17, 18, 19, 20, 25, 26, 28

Dental model kit comprising an attachment plate or an attachment bar to modularly connect the dental model base to an articulator.

3. Claims: 8, 9, 10, 11, 23, 24

Pins for attaching a cast dental model to a model support surface.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PC., JS 00/40326

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